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(71) Applicant: **Intergas B.V.**
NL-7741 KC Coevorden (NL)

(72) Inventor: **Bosscher, Harm**
NL-7943 EJ Meppel (NL)

(74) Representative: **Prins, Hendrik Willem et al**
NL-2517 GK Den Haag (NL)

(54) Method for construction of a heat exchanger and a heat exchanger

(57) The invention relates to a method for manufacturing a heat exchanger by successively:

- shaping at least one liquid pipe into a desired form,
- placing at least a part of the liquid pipe into a mould determining the form of the heat-exchanging surface,
- pouring casting material into the mould,
- causing the casting material to pass into a solid state, and
- removing from the mould the casting with the liquid pipe incorporated therein.

The invention further relates to a heat exchanger manufactured in accordance with this method.

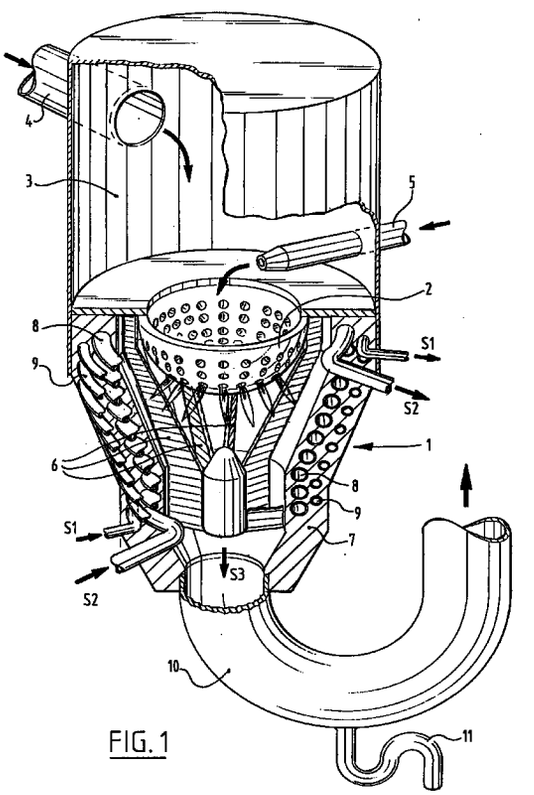

FIG. 1

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Description

The invention relates to a method for manufacturing a heat exchanger, and to a heat exchanger manufactured according to this method.

Existing heat exchangers, for instance for use in a heating boiler for heating water of a central heating system and/or tap water, are usually cast round a sand core. Using the sand core a duct can be left free in the casting which can form for instance the duct for water of a central heating system or tap water. A drawback of this method is that it is relatively labour-intensive to first manufacture and then remove a sand core from the casting. Another drawback to this method is that the duct wall is formed by the casting. The material properties of the wall of the duct are thus determined by the choice of material for the casting material. This causes problems in practice. An aluminium duct wall is thus undesirable in the case of a liquid for transporting which has a pH greater than 8.5; this can occur with water in a closed central heating circuit, while aluminium is very suitable as casting material.

The present invention has for its object to provide a method with which it is possible in simple manner to arrange at least one duct in a casting, wherein the material of the duct wall can differ as desired from the casting material. The invention has the further object of providing a compact heat exchanger manufactured according to this method.

The present invention provides for this purpose a method for manufacturing a heat exchanger by successively:

- shaping at least one liquid pipe into a desired form,
- placing at least a part of the liquid pipe into a mould determining the form of the heat-exchanging surface,
- pouring casting material into the mould,
- causing the casting material to pass into a solid state, and
- removing from the mould the casting with the liquid pipe incorporated therein.

The invention further provides a heat exchanger manufactured according to this method, characterized in that the casting is provided on at least one side with a profiled surface. By placing at least a part of the liquid pipe in the mould the sand core has become superfluous. Another advantage is that different materials are chosen for the duct wall and the casting material. It thus becomes possible to optimize these materials. The method further allows great freedom in respect of the form and the position of the duct in the casting. The heat exchanger thus has at least one profiled side without the direction of the duct, i.e. the position of the liquid pipe, being hereby determined. It is moreover possible to embody the heat exchanger very compactly.

A preferred embodiment of the heat exchanger is characterized in that the profiled surface comprises a substantially lengthwise oriented profile and the liquid pipe is arranged in the casting substantially perpendicularly of the lengthwise oriented profile. With this construction it is possible to realize greater efficiency using the counterflow principle. By supplying a heating gas in lengthwise direction along the lengthwise oriented profile and supplying a counterflow liquid through the liquid pipe a high efficiency can be realized due in part to the comparatively large heat-exchanging surfaces.

Another preferred embodiment of the heat exchanger is characterized in that at least two liquid pipes are arranged in the casting. This heat exchanger can be applied for combined heating of a plurality of liquids, wherein can be envisaged use in a so-called combi-boiler for heating tap water and water of a central heating system. Both pipes are encased with casting material and mutually separated by casting material, whereby the danger of leakages is very small.

Yet another preferred embodiment of the heat exchanger is characterized in that the liquid pipes are arranged practically parallel to each other in the casting. This step enables arrangement of relatively long pipes in the casting, which will enhance the efficiency of the heat exchanger.

The casting is preferably manufactured from aluminium. The liquid pipe is preferably manufactured from copper or stainless steel. Aluminium has the advantage that it has good heat-exchanging properties with a relatively small specific mass. Copper and stainless steel have the advantage that they are not rapidly affected by aggressive liquids.

The present invention will be further elucidated with reference to the non-limitative embodiments shown in the following figures. Herein:

fig. 1 shows a partly cut away perspective view of a burner with a round heat exchanger according to the invention;
fig. 2 shows a partly cut away perspective view of a flat heat exchanger according to the invention; and
fig. 3 shows a perspective view of a mould for manufacturing the heat exchanger of fig. 2.

Fig. 1 shows a round heat exchanger 1 according to the invention in which is placed a burner 2. The burner 2 is connected to a mixing chamber 3 to which air and flammable gas are supplied via an air inlet 4 and a flammable gas inlet 5. The inner surface of heat exchanger 1 is provided with ribs 6 which enlarge the heat-exchanging surface. The ribs 6 form part of casting 7 in which two liquid pipes 8, 9 are arranged. Liquid pipe 8 herein forms the conduit through which water of a central heating system is carried, while liquid pipe 9 forms the conduit through which flows tap water for heating. The liquid in liquid pipes 8, 9 flows spirally upward from below as according to arrows S_1, S_2. The combustion gases flow downward from above as according to arrow S_3, whereby the heating medium and the media for heating flow in opposing directions. The cooled combustion gases are

further discharged via an outlet 10. Due to the high efficiency it is probable that condensation occurs on the underside of heat exchanger 1 and in outlet 10. Condensed liquid is drained via a condensation drain 11.

Fig. 2 shows a flat heat exchanger 12 comprising a casting 13 of which ribs 14 form part and two liquid pipes 15, 16 incorporated in a casting 13. Liquid pipes 15, 16 are incorporated in casting 13 such that the heat-exchanging surface is large. To this end liquid pipes 15, 16 are incorporated in casting 13 in zigzag form. The flow direction of the liquid in the liquid pipes is indicated with arrows S_4, S_5, while arrow S_6 indicates the flow direction of the combustion gas. Use is also made in this situation of the counterflow principle to optimize the efficiency of heat exchanger 12. The heat exchanger 12 shown in this figure can for instance be incorporated into a so-called combi-boiler for household use.

Fig. 3 shows a mould 17 with which the heat exchanger 12 shown in fig. 2 can be manufactured. The liquid pipes 15, 16 are already arranged in the mould 17. Casting material will subsequently be poured into mould 17 via an opening 18. A profiled mould wall 19 comprises a main profile 20 whereby the ribs 14 are formed. After the casting material introduced into the mould 17 has hardened a top plate 21 is removed, whereafter the casting 13 with the pipes 15, 16 arranged therein is removed together with side walls 22, 23 from the mould 17. Finally, the side walls 22, 23 are taken from the casting. Such a method is also known as investment casting method.

Claims

1. Method for manufacturing a heat exchanger by successively:

   - shaping at least one liquid pipe into a desired form,
   - placing at least a part of the liquid pipe into a mould determining the form of the heat-exchanging surface,
   - pouring casting material into the mould,
   - causing the casting material to pass into a solid state, and
   - removing from the mould the casting with the liquid pipe incorporated therein.

2. Heat exchanger manufactured in accordance with the method in claim 1, **characterized in that** the casting is provided on at least one side with a profiled surface.

3. Heat exchanger as claimed in claim 2, **characterized in that** the profiled surface comprises a substantially lengthwise oriented profile and the liquid pipe is arranged in the casting substantially perpendicularly of the lengthwise oriented profile.

4. Heat exchanger as claimed in claim 2 or 3, **characterized in that** at least two liquid pipes are arranged in the casting.

5. Heat exchanger as claimed in claim 4, **characterized in that** the liquid pipes are arranged practically parallel to each other in the casting.

6. Heat exchanger as claimed in any of the claims 2-5, **characterized in that** the casting is manufactured from aluminium.

7. Heat exchanger as claimed in any of the claims 2-6, **characterized in that** the liquid pipe is manufactured from copper or stainless steel.

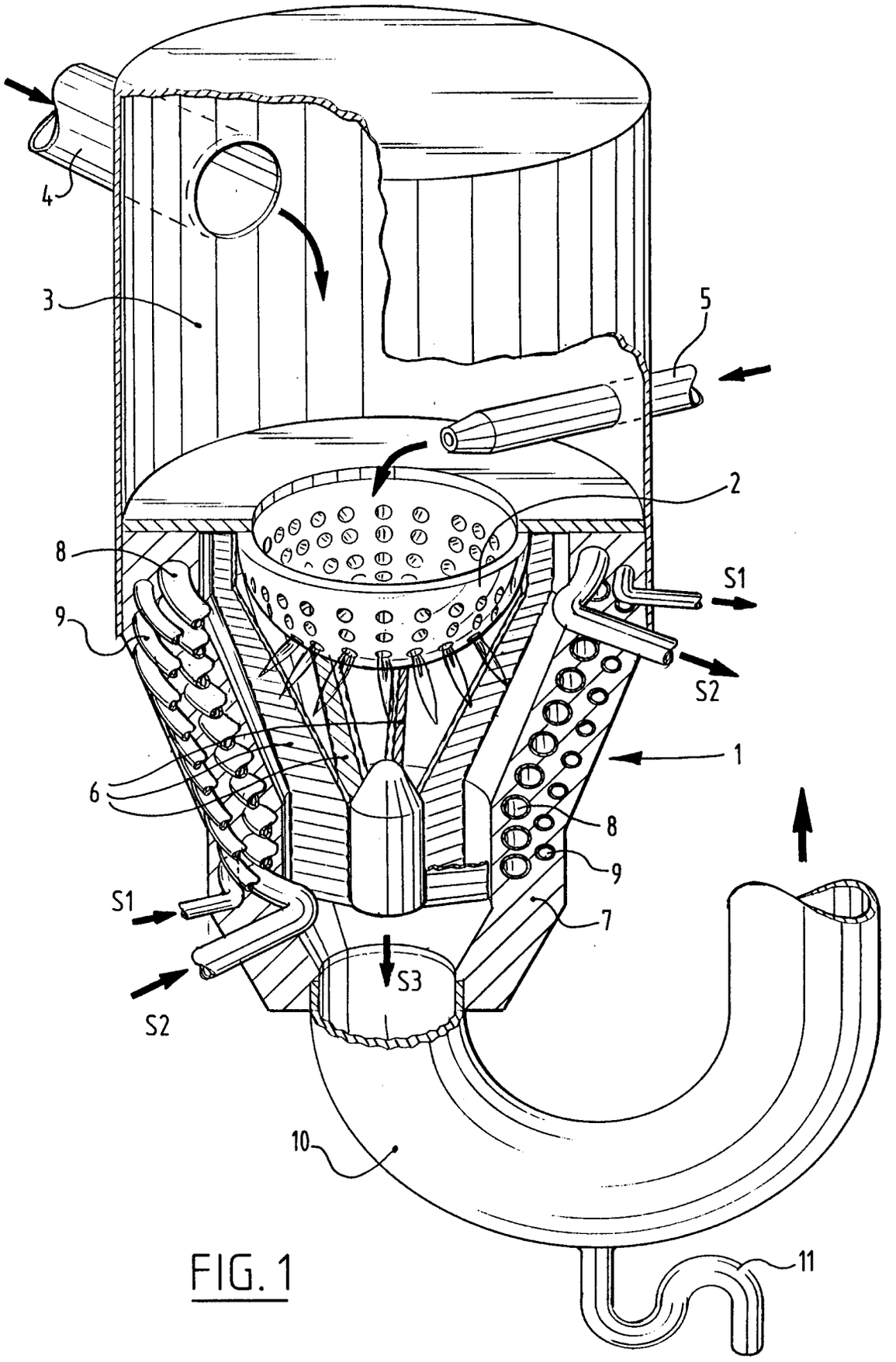

FIG. 1

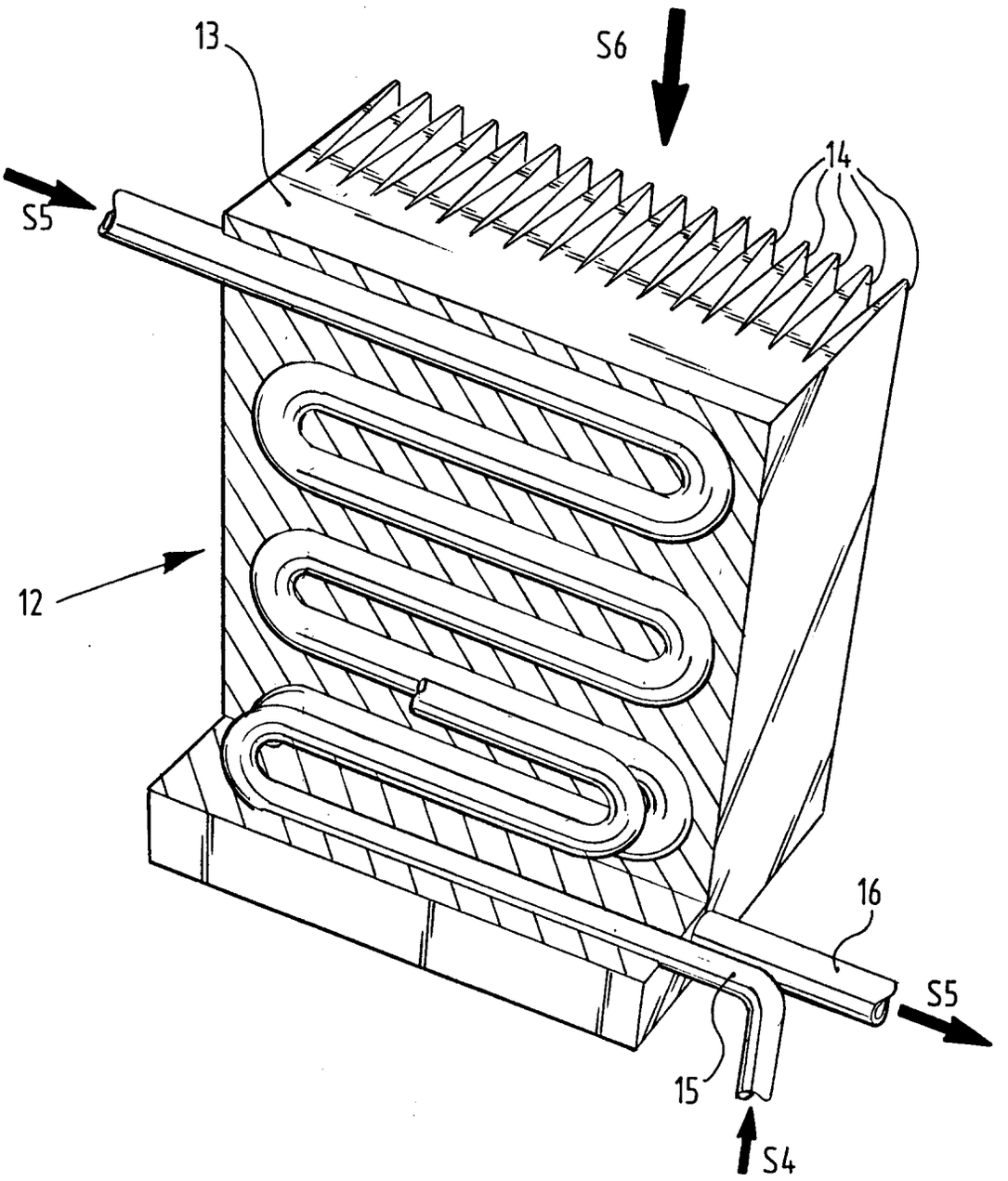

FIG. 2

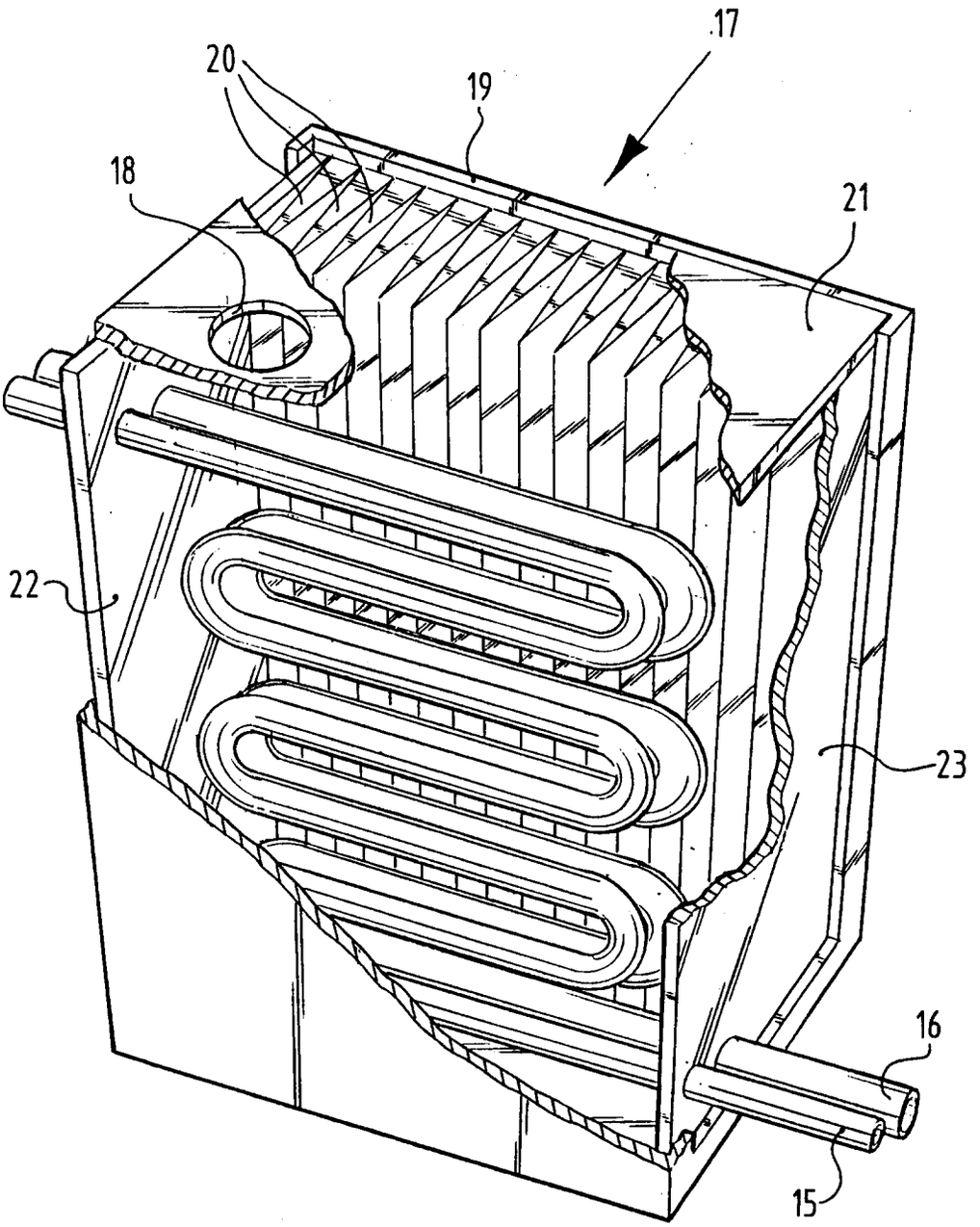

FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 95 20 1661

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	WO-A-85 01101 (ÖSTBO) 14 March 1985 * abstract * * page 1, last paragraph *	1,2,4-7	F28F7/02 B22D19/00 F24H1/38
X	EP-A-0 495 762 (NORDINVENT S.A.) 22 July 1992 * column 2, line 21 - column 2, line 26; claims 1,5 * * column 2, line 48 - column 2, line 53; figures *	1-7	
X	US-A-5 305 818 (DARSY) 26 April 1994 * abstract * * column 2, line 41 - column 2, line 45 *	1	
X	US-A-4 865 112 (SCHWARB) 12 September 1989 * column 3, line 37 - column 4, line 14; figures *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F28F
B22D
F24H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	3 October 1995	Van Gestel, H

CATEGORY OF CITED DOCUMENTS

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